WoodRoll® – a multipurpose gasification technology

➢ First results from catalytic hydrotreatment of pyrolysis oil from slow pyrolysis

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Taking bioenergy forward!

CORTUS ENERGY

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CORTUS ENERGY

Company history

2006–2010
- The WoodRoll® technology invented and Cortus Energy is founded. The technology is confirmed on a small scale (150 kW)

2011–2013
- ½ MW gasifier followed by verifying all sub-processes in the WoodRoll®.

2014–2015
- The plant in Köping is upgraded to a complete reference and test plant. WoodRoll® fully integrated. Design of first commercial 6 MW modular WoodRoll® plant is initiated

2016-2017
- Basic engineering is performed for two 6 MW WoodRoll® plants (the projects in Höganäs and Japan), strategic cooperation agreement is signed with Forest Energy (Japan), the Höganäs project is granted SEK 47.6m in subsidy and the project in California USD 5m.

2018-2021
- The construction of the 6 MW WoodRoll® together with Höganäs. Commissioning & Start-up is ongoing.
- Cortus has financed this plant and will deliver energy gas on a 20 years contract.

2022 Project pipeline

Green H_2/CO_2 FR
6 MW Hydrogen from biomass, pre-study completed

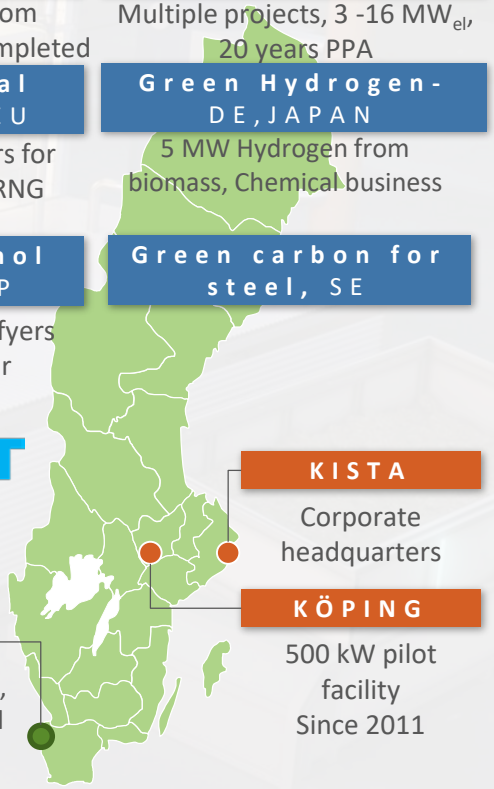
Green Power USA, FR
Multiple projects, 3 -16 MW_{el}, 20 years PPA

Green Natural Gas-SE/FIN/EU
6 and 20 MW gasifyers for cat-process to SNG/RNG

Green Hydrogen- DE,JAPAN
5 MW Hydrogen from biomass, Chemical business

Green Methanol SE/NO/EU/JP
Multiple 20 MW gasifyers for cat-process for Methanol

BIOJET



KISTA
Corporate headquarters

KÖPING
500 kW pilot facility
Since 2011

HÖGANÄS
Industrial reference plant, 6 MW modular WoodRoll

33 Employees

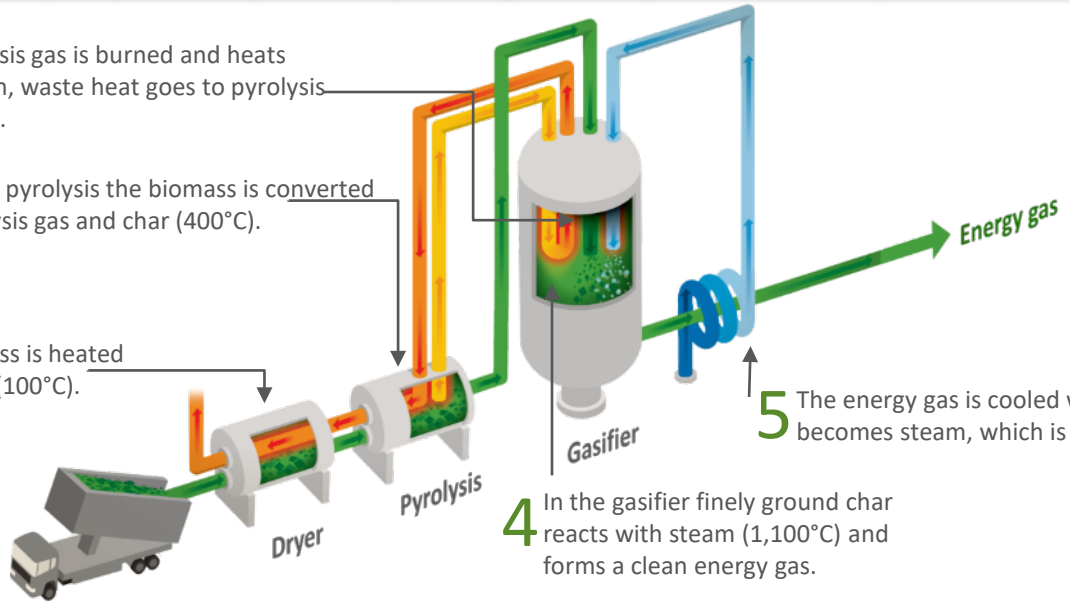
WoodRoll® – A breakthrough & patented gasification system

A proprietary & fully integrated gasification process

3 The pyrolysis gas is burned and heats gasification, waste heat goes to pyrolysis and drying.

2 During the pyrolysis the biomass is converted into pyrolysis gas and char (400°C).

1 The biomass is heated and dried (100°C).



4 In the gasifier finely ground char reacts with steam (1,100°C) and forms a clean energy gas.

5 The energy gas is cooled with water becomes steam, which is fed to the

Strong patent protection

6 PATENT FAMILIES

162 confirmed patents

1. Gasification process
2. Hydrogen from gasification
3. Indirectly heated gasifyer
4. Steam/char injector in WR
5. Biocoke process in WR
6. Pure hydrocarbons from WR

FEEDSTOCK OPTIONS

Wood

- ✓ Wood chips, bark
- ✓ Saw dust, recycled wood
- ✓ Branches, roots and tops

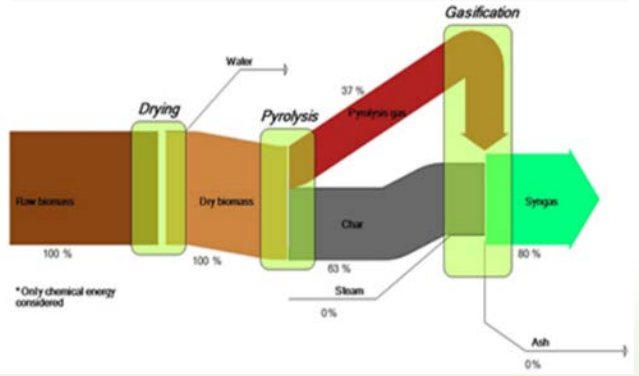
Crops

- ✓ Vine tree
- ✓ Vine cutting
- ✓ Stem with leaves
- ✓ Roots

Industrial waste

- ✓ Fiber sludge
- ✓ Chemical sludge
- ✓ Furniture manufacturing

ENERGY BALANCE – 80% YIELD



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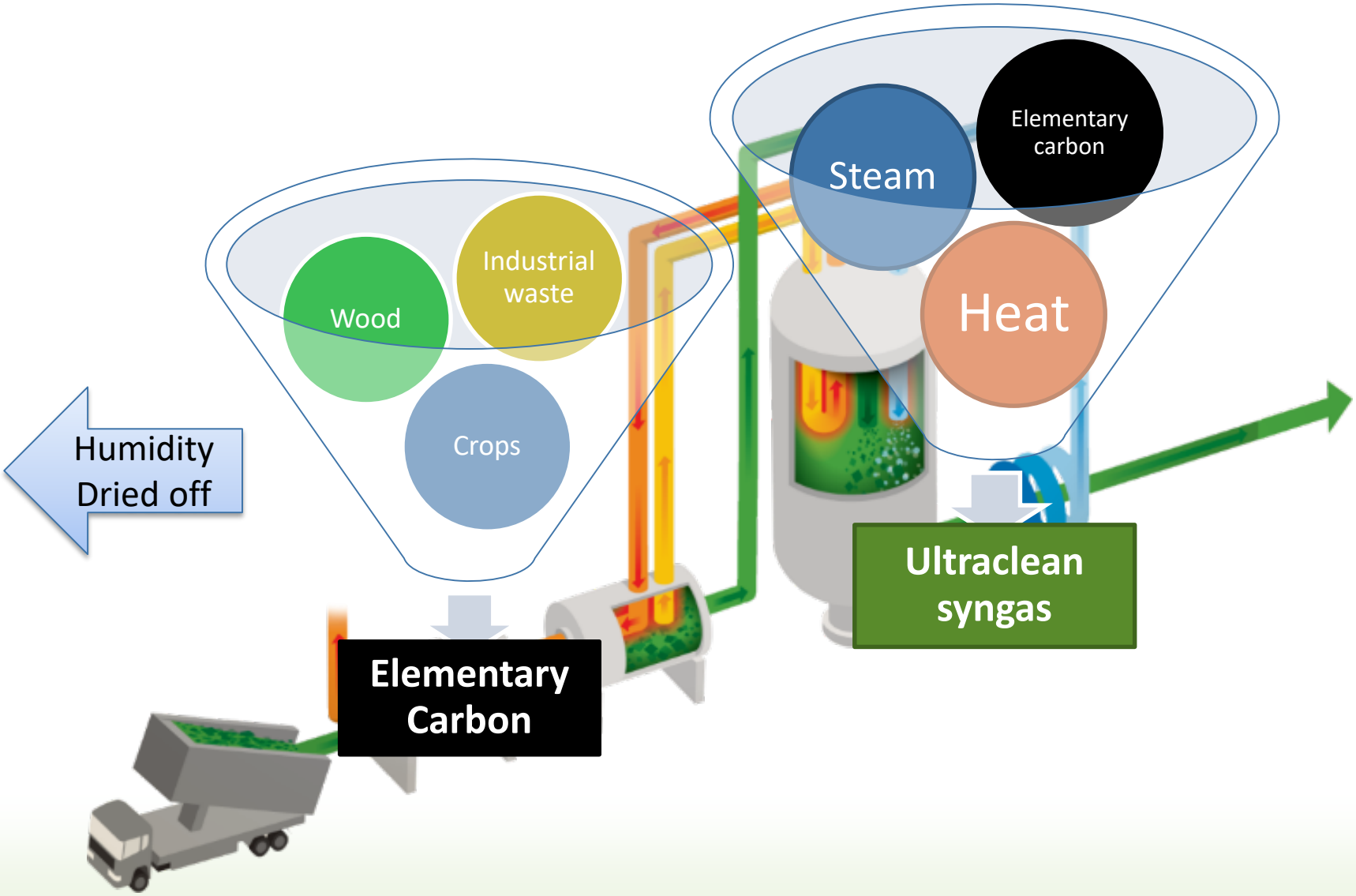
WoodRoll® – gasification basics



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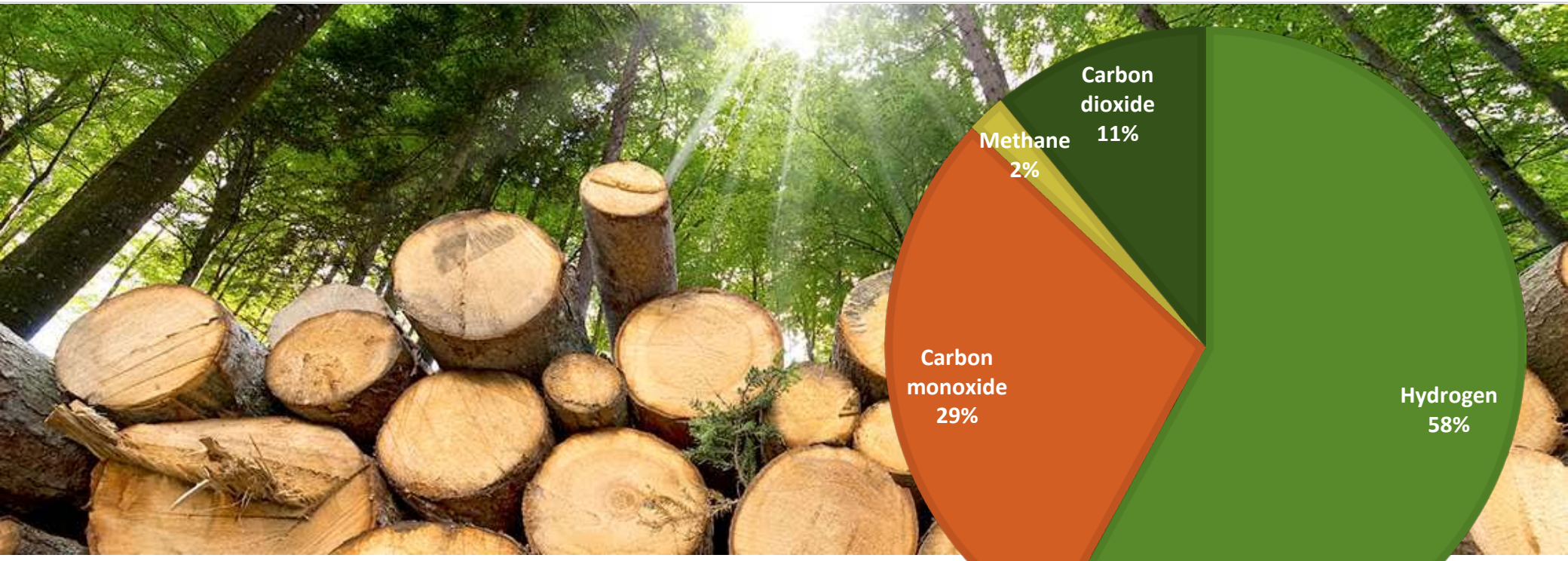
WoodRoll® - Bridging the gap from low grade biomass to industry and transport requirements

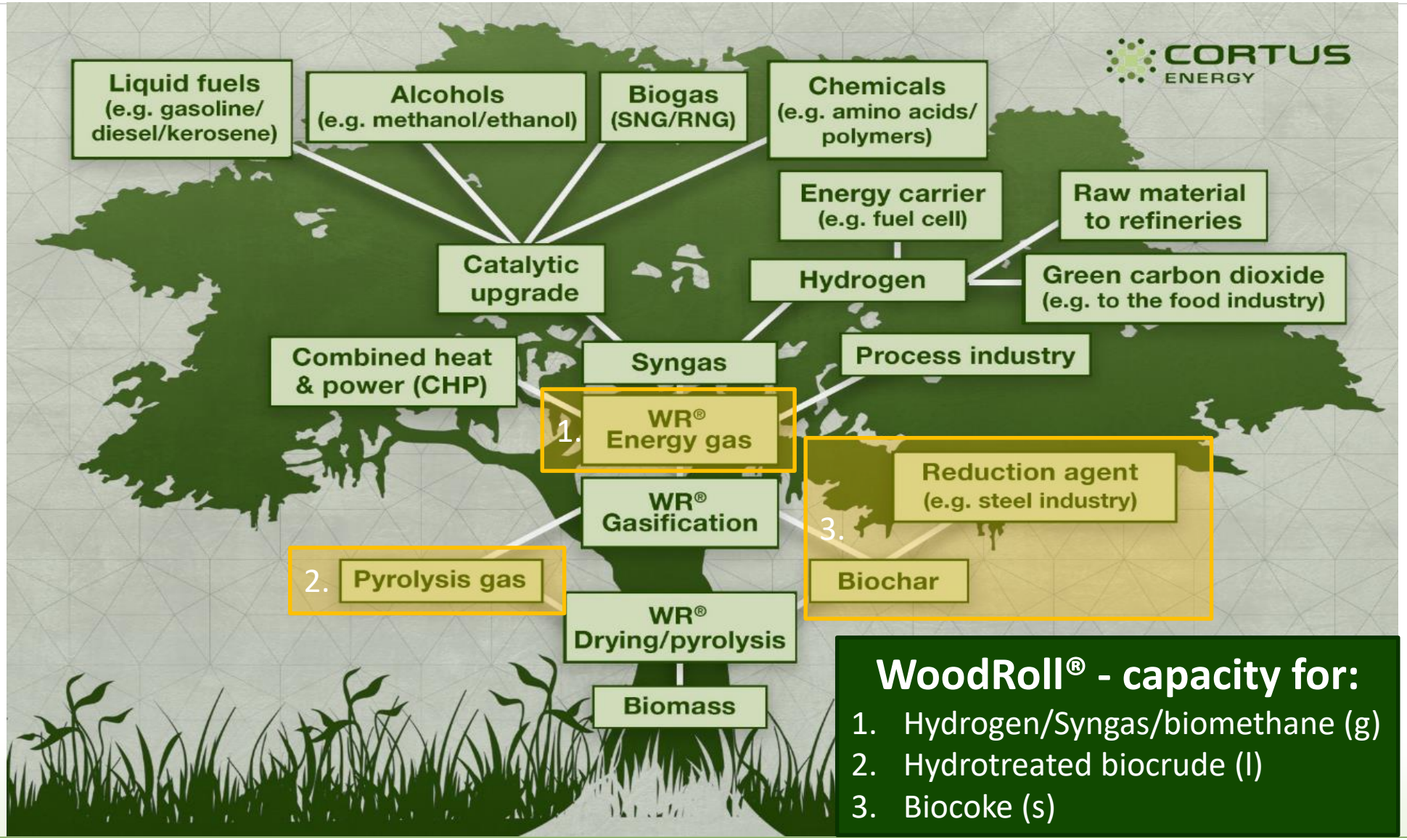


SYNGAS COMPOSITION

Our goal is to help customers lower CO2 emissions by more than 1 Mton per year by 2030

CORTUS ENERGY

WoodRoll® application tree – true biorefinery technology!



WoodRoll® - capacity for:

1. Hydrogen/Syngas/biomethane (g)
2. Hydrotreated biocrude (l)
3. Biocoke (s)

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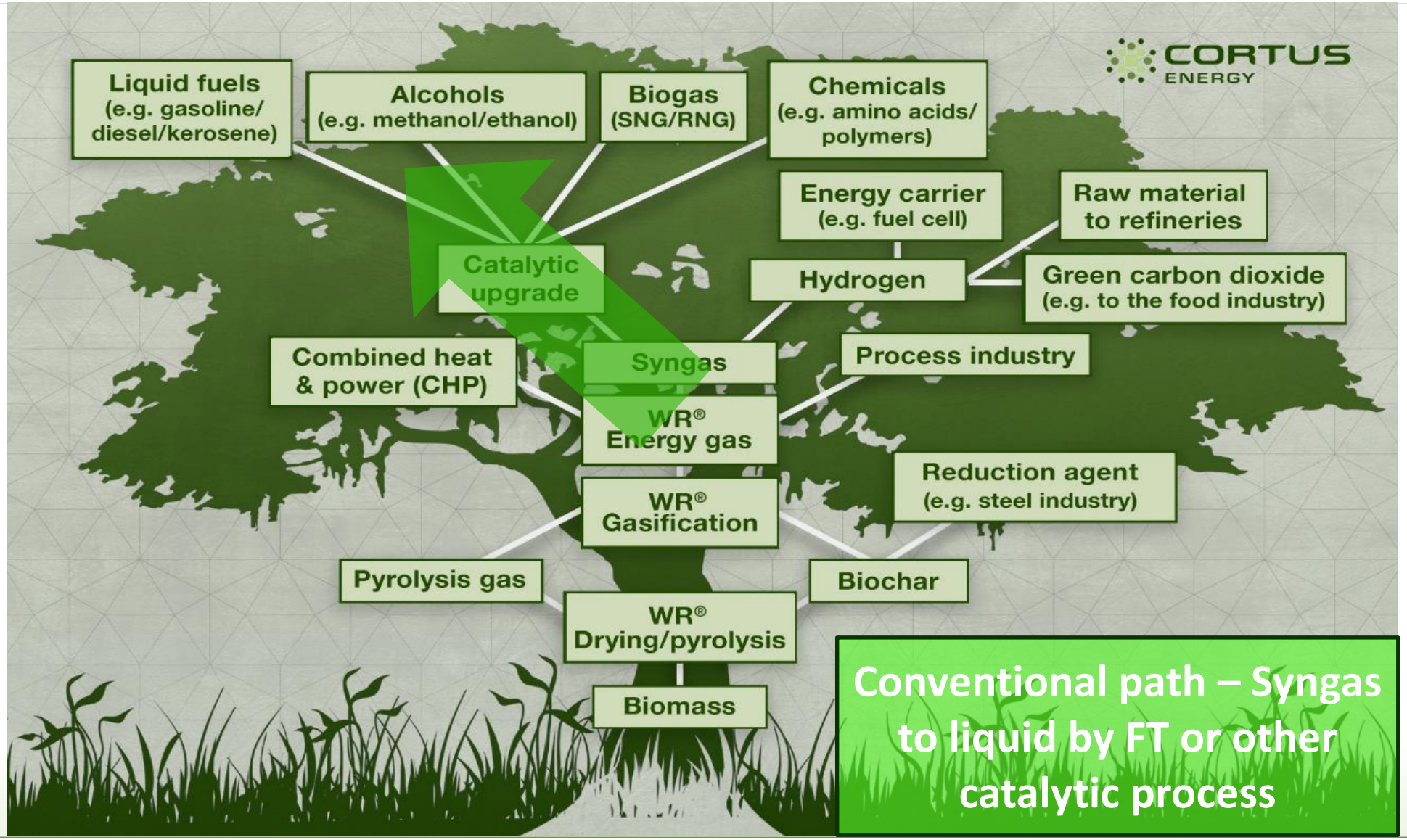
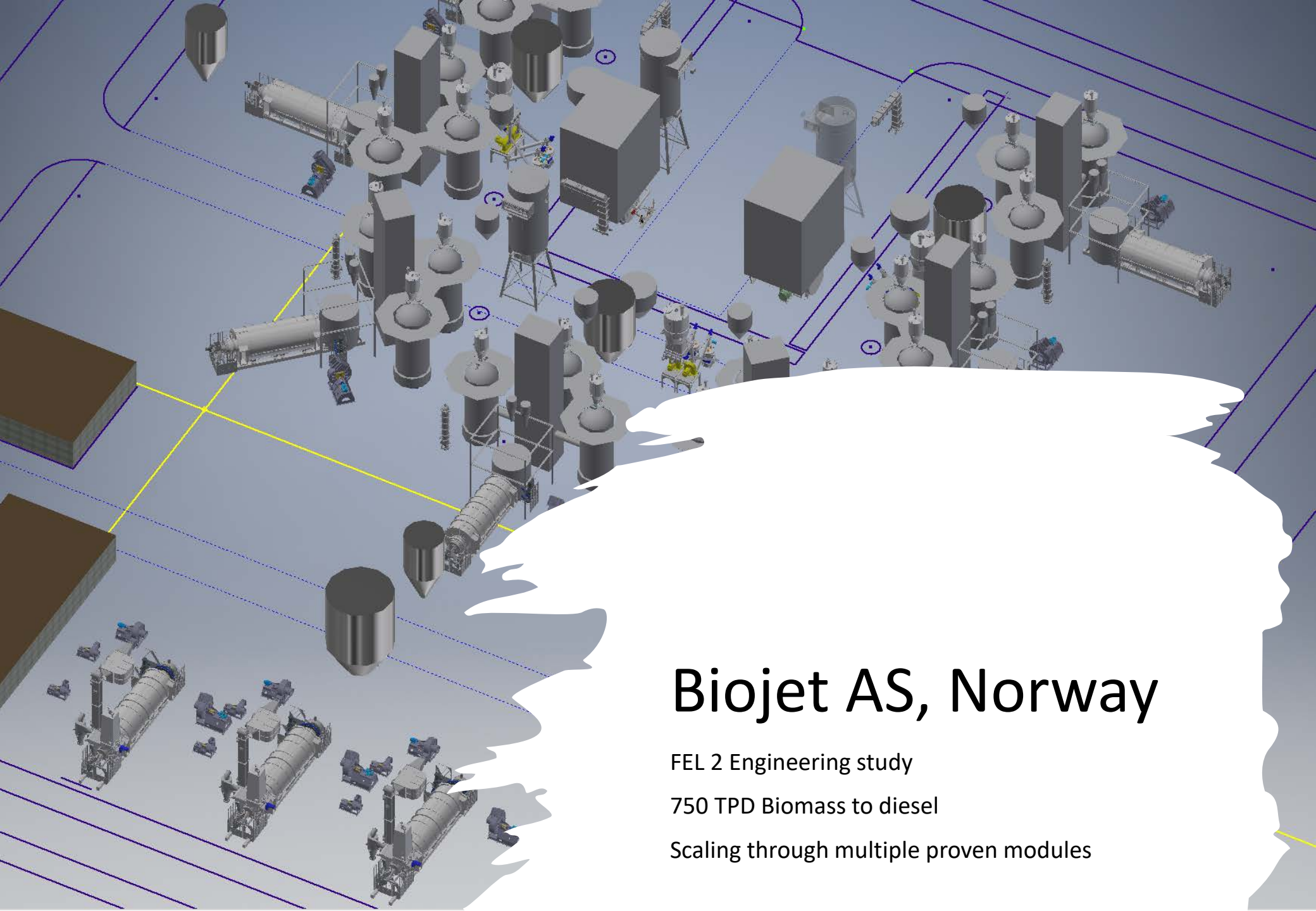




Biojet AS, Norway

FEL 2 Engineering study

750 TPD Biomass to diesel

Scaling through multiple proven modules

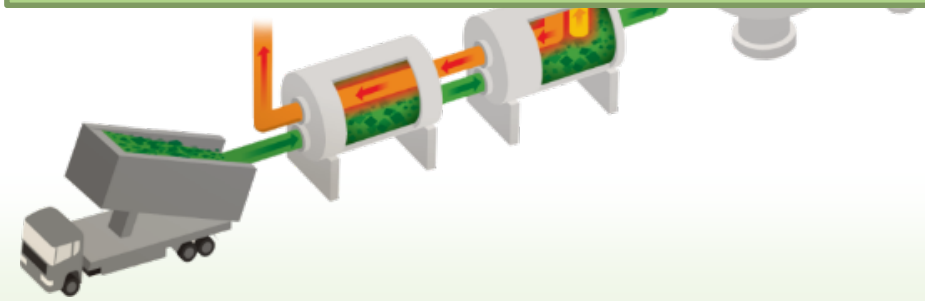
WoodRoll® – Cracking of pyrolysis gas - 2016

HALDOR TOPSØE

Heavy hydrocarbons broken up into lighter molecules

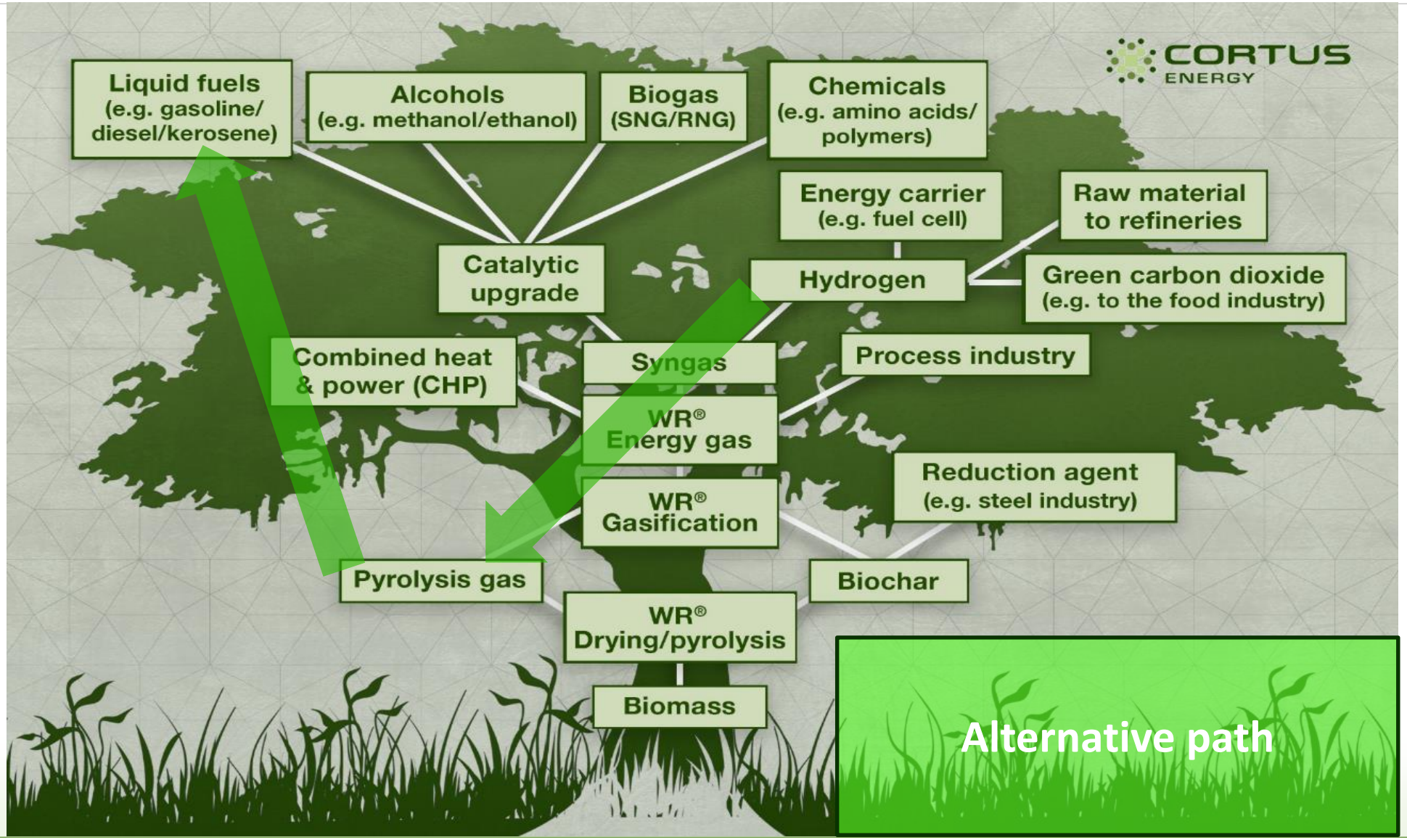
IDEA OF UTILIZATION OF HEAVY HYDROCARBONS FROM PYROLYSIS GAS WAS BORN

e for treated oil is longer than raw
as easier to burn which ended up in
on zone as well as more evenly
erature profile.

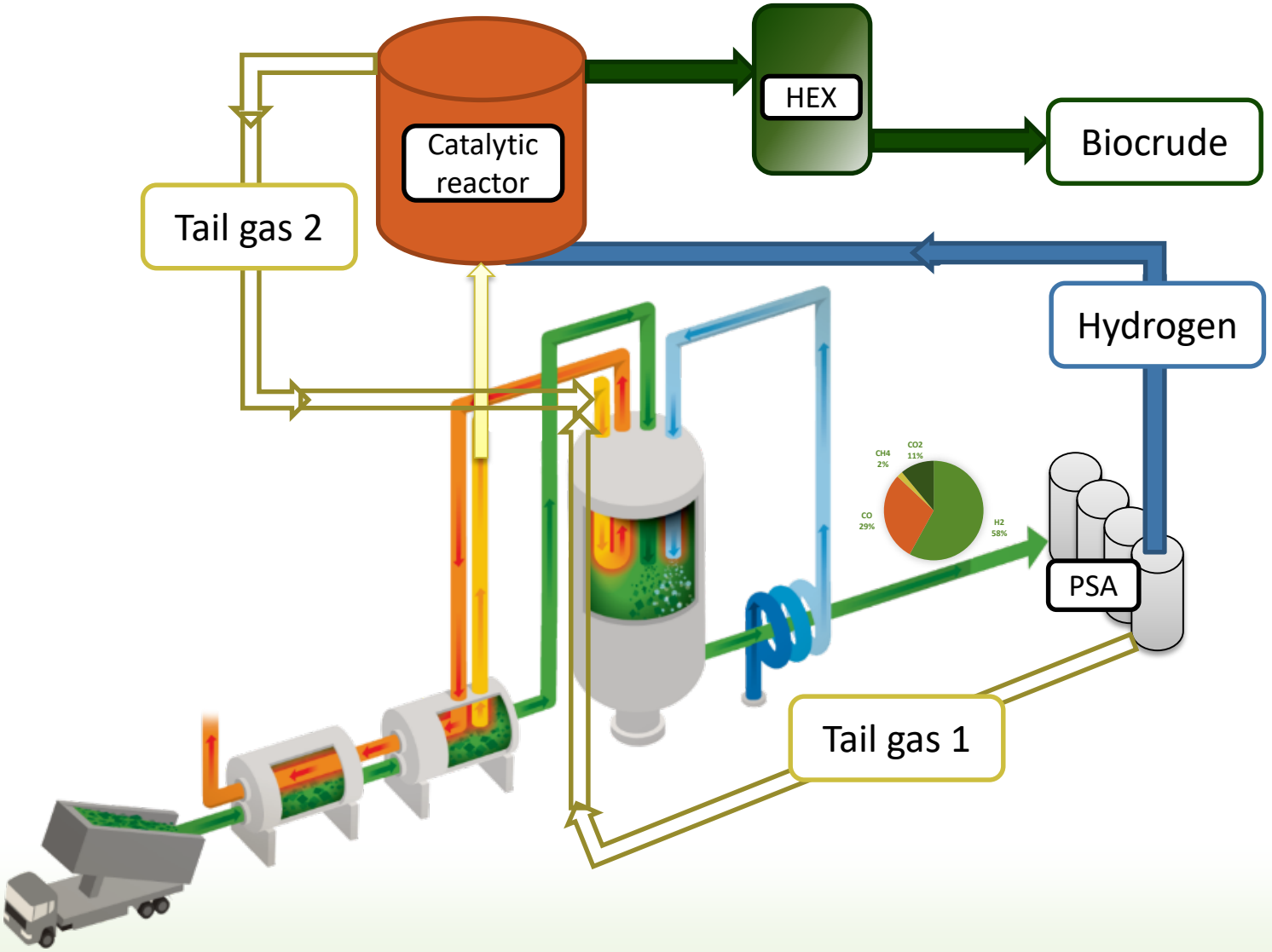


CORTUS ENERGY

WoodRoll® application tree – true biorefinery technology!



WoodRoll® – Hydrogenation - 2021



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WoodRoll® – Hydrogenation - 2021

Main results from the tests:
1. The catalytic upgrading of the pyrolysis vapor resulted in a pyrolysis oil fraction with improved stability properties, i.e., decreased oxygen content (18 % → 12 %) and carbonyl content, compared with pyrolysis oil produced from thermal slow pyrolysis.

2. Slightly lower yield of the liquid oily fraction and slightly higher gas yields were detected at the catalytic hydropyrolysis compared to the thermal slow pyrolysis.

3. Points 1 and 2 indicate a possibility to use this oil to produce more high value products, such as biofuels and chemicals as a by-product from Cortus WoodRoll concept.

Next steps:
1. Application for next project made together with partners for longer runs and deeper analysis of the pyrolysis oil.
2. Analysis of produced oil to be made by possible existing and new customers.

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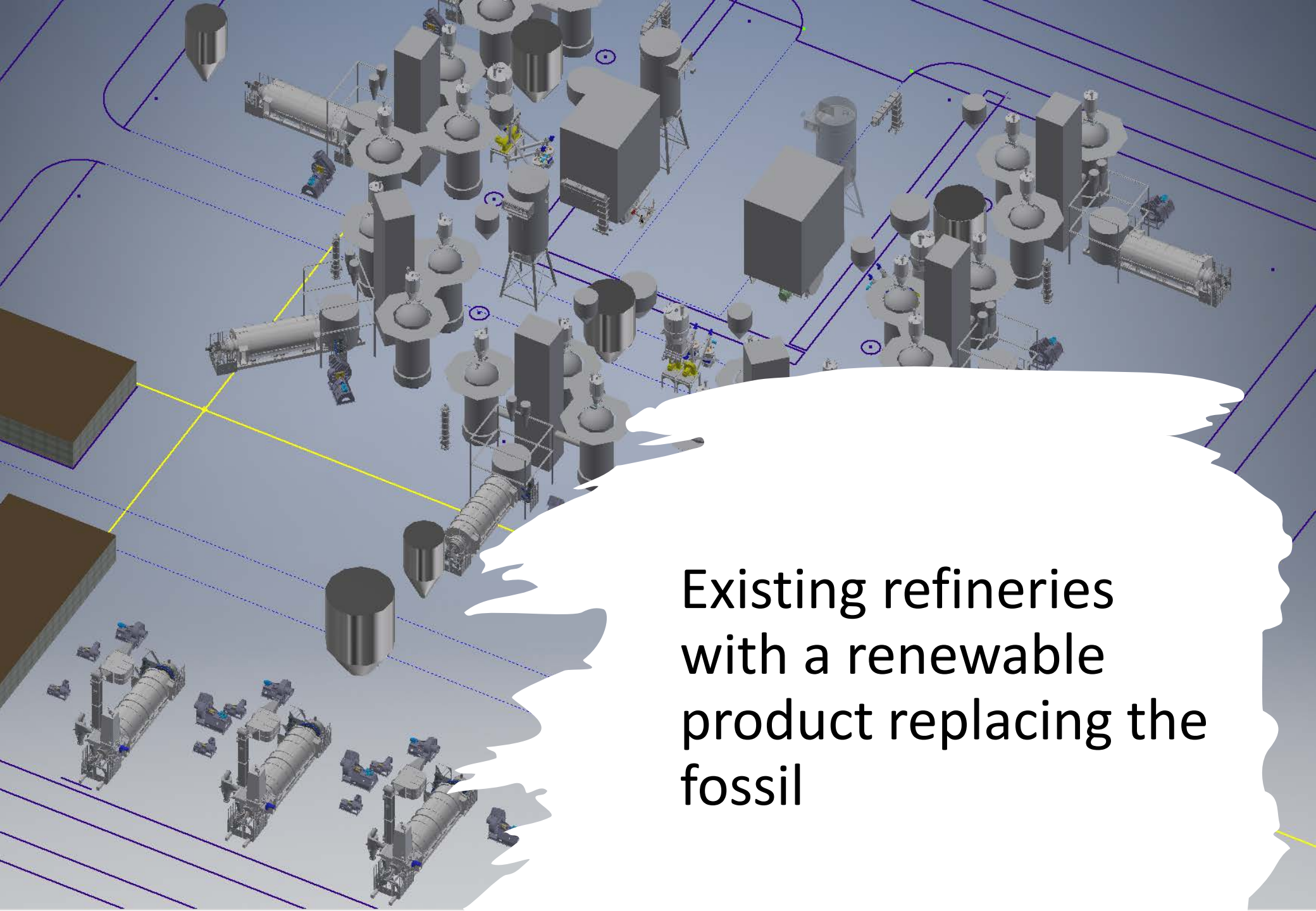
New customers based on renewable resources

BIOJET



Existing refineries with a renewable product replacing the fossil


thank you
danke
謝謝
ngiyabonga
teşekkür ederim
gracias
merci
obrigado
dziękuję
bedankt
hvala
mauruuru
dank je
go raibh maith agat
sukriya
kop khun krap
terima kasih
grazie
arigatô
takk
dakujem
tapadh leat
mochchakkeram
спасибо
рахмат
Баярлалаа
danke
mersi
barka
welalin
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kia ora
vinaka
blagodaram
misaotra
matondo
paldies
grazzi
mahalo
хвала
asante
manana
obrigada
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chokrane
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감사합니다
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তোমাকে ধন্যবাদ
trugarez
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ENERGY